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ABSTRACT

Presented is a description of the activities of a metric education project. Activities included but were not limited to: inservice teacher education, public awareness and consumer education, and establishment of a regional metric center. Among the attachments are the outline for the training sessions, the demonstration inventory of materials, and a summary of data that support the success of this project. (MK)

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FINAL REPORT
REGIONAL IMPACT IN METRIC EDUCATION-A MULTIDISCIPLINARY APPROACH TO METRICS

BEST COPY AVAILABLE

Willis N. Johnson, Project Director
Department of Instruction and Learning
Murray State University
Murray, Kentucky 42071

DHEW Project Number 561AH70073
Grant Number G00700834

SE 030 529

PROGRAM PERFORMANCE: FINAL REPORT

1. PROJECT NO.: 561AH70073

2. GRANT NO.: G007700834
Education for the Use of the Metric System of Measurement Program.

3. TITLE OF PROJECT: Regional Impact in Metric Education A Multidisciplinary Approach To Metrics. Dated 01/31/77 as amended 05/13/77.

4. GRANTEE ORGANIZATION: Murray State University College of Human Development and Learning.

5. PROJECT DIRECTOR: Dr. Willis N. Johnson.

6. PERIOD COVERED: FROM 07/01/77 TO 09/30/78.

7. ACCOMPLISHMENTS DURING THIS PERIOD:

This project originally consisted of six components before there were considerable budget amendments. Every attempt was made to meet all objectives by working through the original priority listing of these objectives as described in the original proposal.

The components are:

I. Planning and Organization - August and September.
II. Development of Training Program - October through December.
III. Inservice Teacher Education - January through July.
IV. Pre-service Teacher Education and University Training - January through May.
V. Public Awareness and Consumer Education - January through July.
VI. Establish a Regional Metric Center - August through July.

Components I - IV have been completed. Component V was met in cooperation and collaboration with the Kentucky Chamber of Commerce and the Murray State Adult Basic Education Program. Component VI has a good start but it is not quite yet functional as a regional center.

MAR 1 4 1980

8. MAJOR ACTIVITIES AND EVENTS:

Through negotiations with the school systems in the twenty westernmost counties of Kentucky, there was a great commitment on the part of the participating schools. Approximately one teacher for each fifteen teachers in the school systems was trained. One hundred thirty-five teachers were trained by this project. Therefore, by the multiplier effect, this project should have reached 2,025 teachers. Also, the training program was placed in the hands of an additional 2,275 teachers who were either students in university classes or from school districts that did not participate in the training program. (See attachment A for a graphic representation of this project's training efforts.)

This project provided training from five centers of operation around Western Kentucky. (See attachment B.) All inservice training sessions were held during regular school hours. Consequently, the systems had to accept the responsibility for paying for substitute teachers, travel, etc.

Attachment C provides the outline for the twelve hour training sessions.

Attachment D provides the demonstration inventory of materials shared with participants.

Attachment E gives the summary of data that supports the success of this project. The participants perceived the training of this project as positive and beneficial.

Attachment F gives inventory of items distributed to participants.

Accompanying the report is the Measurement Module that was prepared for use in training.

9. PROBLEMS:

The only problems were the delays presented by the winter storms of 1978. The training sessions were rescheduled. Additionally, it was not

an easy matter to gather follow-up data on how the training sessions within the schools actually went. However, at the time of this writing, many schools report that metric training sessions were administered.

10. PUBLICITY ACTIVITIES:

N/A

11. DISSEMINATION ACTIVITIES:

N/A

12. PROGRESS ON DATA COLLECTION AND EVALUATION PLANS AND PROCEDURES:

Participants completed bibliographic data forms (attachment G), workshop evaluation forms (attachment H), pre and post tests on "thinking metric" (attachments I & J).

13. OTHER ACTIVITIES:

N/A

14. STAFF EMPLOYMENT AND UTILIZATION:

The staff employed and used in this project were from industry and technology, public school mathematics teacher, science education, or mathematics education. A half-time secretary was also employed.

The staff had the responsibility of planning, training, and consulting on metric training sessions.

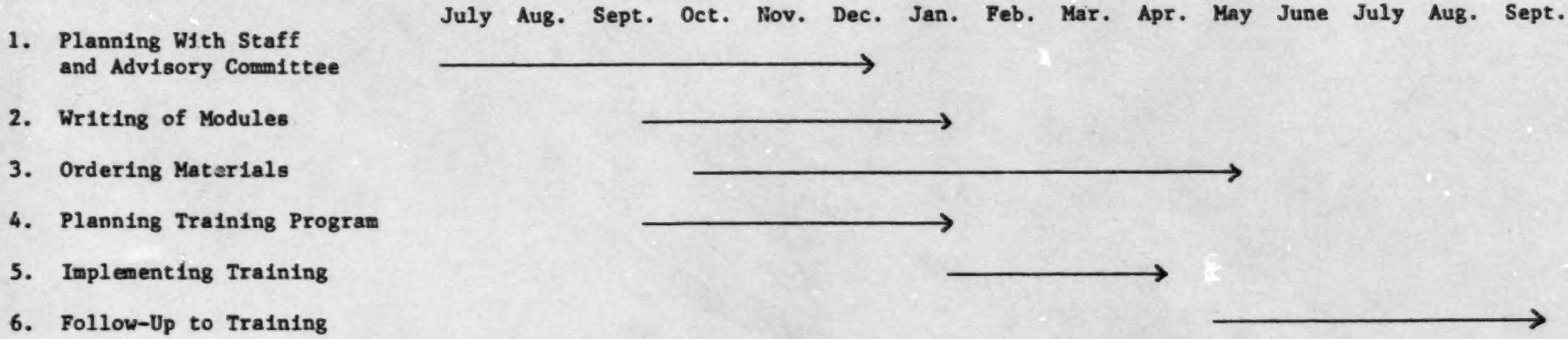
15. STAFF DEVELOPMENT:

The project director and the other training staff worked together in planning materials and the format of training sessions. The training staff worked through the first training session for inservice teachers together.

This facilitated the "debugging" necessary. Attachment K gives the guidelines for using the Measurement Module.

16. N/A

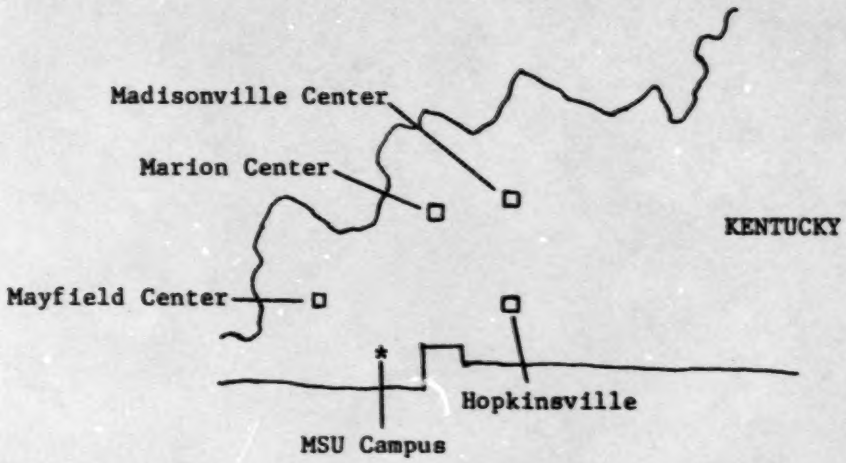
PROJECT TRAINING EFFORTS
1977


July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept.
1. Planning With Staff and Advisory Committee
2. Writing of Modules
3. Ordering Materials
4. Planning Training Program
5. Implementing Training
6. Follow-Up to Training

Attachment A

STAFF

Science Education - Roger Childress
Mathematics Education - Willis Johnson
Industry & Technology - Eugene Schanbacher
Public School Teacher - Dorothy Thompson



Each center's Metric Education (this project) was responsible for follow-up counseling, etc.

Each participating school district took financial responsibility for sending trainees (approximately 1 for every 15 teachers in the district).

INTRODUCTION Approx. 1.5 hours

0.25 hr. General Statement - Advance Organizer for training

0.25 hr. Scenario depicting the pro - con arguments on metrication

0.5 hr. Pretest

0.35 hr. Film - The Metric System (Organizer)

MEASUREMENT Approx. 1.0 hours

0.25 hr. History - (audio-visual presentation)
&
0.45 hr. General Definition of measures/comparison i.e. length area, etc.

LENGTH Approx. 1.0 hours

Conversions

SI Notation

Estimation

Measuring

Gaming

Comparison of calculations

Advantages of SI

MASS & WEIGHT Approx. 1.0 hours

Conversions

SI Notations

Estimation

Measuring

Gaming

Comparison of calculations

Advantage of SI

Attachment C (cont'd)

TEMPERATURE Approx. 0.6 hours

0.1 hr. { SI Notation
Celsius & Kelvin

0.5 hr. Estimating/Predicting

Ongoing Thereafter

AREA Approx. 1.0 hours

Conversions

SI Notation

Estimation

Measuring

Gaming

Comparison of calculations

Advantage of SI

VOLUME & CAPACITY Approx. 1.0 hours

Conversions

SI Notation

Estimation

Measuring

Gaming

Comparison of calculations

Advantages of SI

METRICS FOR EVERYDAY USE Approx. 1.0 hours

7 Base units/common prefixes

clothing

food

traveling

medicine

utilities

weather

sports

COMMERCIAL & VOCATIONAL USE Approx. 2.0 hours

2.0 hr. Examples from the Ohio Voc. Ed. Center. There are seventy or so to choose from.

EXPLORING CURRICULA OBJECTIVES IN THE GRADES Approx. 0.5 hours

0.5 hr. Knowledge & intuitive skills & concepts attainable at various grade levels.

EXPLORING CURRICULA MATERIALS Approx. 1.0 hours

1.0 hr. Reading
Textbooks
Activity Books
Hardware
Laboratory Kits
films
services available
Samples
} free & otherwise

Ongoing thereafter

POSTLUDE & CONCLUSIONS Approx. 1.25 hours

0.75 hr. Distribution of materials
Guide for training others

0.5 hr. Post test

Attachment D

INVENTORY - WORKSHOP 1

1. Activity Manual
2. Scenario
3. Pretest
4. Answers to pretest
5. 23 cm^2 board
6. Movie
7. Bathroom scale
8. 2 liter Coke bottle
9. Coke can
10. 4 cans
11. Pitcher
12. Measuring cup
13. Rice
14. Beans
15. Potatoes
16. Orange
17. Large mass
18. Salt
19. Liter (beaker units)
20. 2 X 4
21. Quart Coke bottle
22. Pan balance & mass pieces
23. 1 kg mass
24. Trundle wheel
25. Caliper or micrometer
26. Meter sticks
27. Measuring tapes
28. Thermometer
29. Spring scales
30. Mesh bags
31. Paper clips
32. Platform scale
33. Ball

Attachment D (cont'd)

WORKSHOP 2 - DEMONSTRATION INVENTORY

1. "Moving Toward Metric" J. C. Penny
2. "Metric Song" J. C. Penny
3. "All Together Now - Teach Metrics"
4. "A parent's Guide to Homework"
5. "Metrics in the K-8 Curriculum"
6. "Materials Evaluation Forms"
7. Criterion-Referenced Metrics Tests
8. "The Metrics Are Coming"
9. SI Metric Handbook
10. Metric Exercises
11. Metric Is Coming
12. Measurement and the Metric System I
13. Measurement and the Metric System II
14. Basic Guide to Metric
15. Creative Publications '78 Catalog
16. The Metric System for Elementary Schools
17. The Metric System (Content & Methods)
18. The Metric System Is
19. The Celsius Thermometer Is
20. The Meter Is
21. The Gram Is
22. The Liter Is
23. Activities Handbook for Teaching the Metric System
24. The Metric System Day to Day
25. The International Metric System and How It Works - Hopkins
26. Clippings, Articles, Etc. Notebook - METS

Attachment D - Workshop 2 (cont'd)

27. Make Your Own Metric Measuring Aids
28. Metric News Journal - Sept./Oct. 1977
29. 2 to Getset
30. Sears - catalog, Teaching Metrication, Pres. Speech
31. KET Schedule
32. U. S. Metric Association Newsletter
33. Items available from U.S. Dept. of Commerce
34. Metric Commission Canada (free)
35. Early Years - 1975 April
36. Home Metrics
37. Moving to Metrics - Home Ec. Association
38. Metric Fun Activity Cards - Primary
39. Metric Fun Activity Cards - Intermediate
40. Metric System Teaching Tapes - Duncan
41. EOP - Henderson, KY Metric Grant
42. Common Sense Metric Manual
43. Metric for Good Measure (Manuals from Ohio Vocational Education)
44. Ideal Teaching Thermometer Chart
45. KET Measure Metric Teacher's Guide
46. Introduction to the Metric System (Canada) free
47. NIE Metric Education Pamphlet
48. Metric in a Nutshell
49. Metrics Primer
50. Textbooks
51. Charts
52. Exemplary transparencies

Attachment E

Summary of Feedback

n = 130 Scale = 1 to 10, with 10 more than adequate.	Mean
1. Provided an opportunity to clarify the changeover issue to the international (SI) metric system.	8.7
2. Enhanced your understanding about the teaching of measurement.	8.5
3. Enhanced your repertory of ideas and activities for teaching measurement.	8.8
4. Enhanced your understanding of how the metric (SI) system works.	8.5
5. Gave suffieient ideas and materials for training peers or adults.	8.4

Additionally, almost all stated, "I will upgrade my emphasis about teaching metric measures--at least to the recommended emphasis.

Attachment F

DISTRIBUTION INVENTORY

1. Meter sticks
2. Beaker sets
3. Excerpts from "All Together Now - Teach Metrics"
4. Bulldog clips
5. Article from Teacher - "Metrics Are Coming"
6. Valerie Antoine's "Answers to a Few Questions . . ."
7. Paper clip - mass pièces
8. Masking tape - to make mass balance
9. Participant data sheet
10. "A Parent's Guide to Homework"
11. Blank teaching thermometers
12. Booklet, "The Metrics Are Coming"
13. ERIC Microfile listing of Vocational Module
14. Three Parts for Secondary Workshop
15. Riedesel Objectives for the grades
16. Handout
    - Making Balance Beam with Meter Stick, itc.
    - Clothing Guide
    - Mileage, gas tire pressure
    - Cooking, personal mass, wallet shopper
    - Map USA
    - Metric Measuring License
17. SRA - Scenario
18. Workshop Evaluation Form
19. Measuring tapes
20. Posttest
21. Posttest answers
22. Composite tests - forms 1 & 2

Attachment G

PARTICIPANT DATA SHEET

Last Name _____, First _____

School _____

The number of teachers that you represent: _____

What are the level(s) and area(s) of these teachers?

What sort of industry is in your school's community?

Give us a little background concerning your education and teaching.

Thank you.

INSERVICE PARTICIPANT FEEDBACK
MURRAY STATE UNIVERSITY METRIC EDUCATION

Please give us necessary feedback regarding how well our objectives were met. Also, additional suggestions for improvement will be appreciated.

On a scale from one to ten (1-10) with ten implying our efforts were "more than adequate".

Example: Supplied ideas for measurement projects.

inadequate — more than adequate

(Y'all didn't do a good job.)

1. Provided an opportunity to clarify the changeover issue to the international (SI) metric system.

inadequate — more than adequate

2. Enhanced your understanding about the teaching of measurement.

inadequate — more than adequate

3. Enhanced your repertory of ideas and activities for teaching measurement.

inadequate — more than adequate

4. Enhanced your understanding of how the metric (SI) system works

inadequate — more than adequate

5. Gave sufficient ideas and materials for training peers or adults.

inadequate — more than adequate

To what degree did the inservice session(s) change your attitude about teaching metric (SI) ideas. Indicate with a check (✓).

_____ I will emphasize <u>less</u> about metric measures in my teaching from now on.

_____ I will <u>maintain</u> my present emphasis about teaching metric measures - which includes the recommended emphasis about metric measures.

_____ I will <u>maintain</u> my present emphasis about teaching metric measures - which does not include the recommended emphasis about metric ideas.

_____ I will <u>upgrade</u> my emphasis about teaching metric measures - at least to the recommended emphasis.

The grade(s) which you presently teach is _____.

To have an effective inservice program, I recommend that you. . .(please complete this statement if you desire.)

Form 1

STUDENT TEST BOOKLET

for

METRICS FOR GOOD MEASURE

LEVEL III

Directions

This test has 30 questions. Read each question carefully. There are three kinds of questions on this test.

One type of question is a multiple-choice question. Read each of the possible answers below the question. Pick the number of the answer you think is best. Write the number of this answer in the blank in the question.

Example:

0. There are (3) metres in one kilometre.

(1) 10
(2) 100
(3) 1 000
(4) 10 000

There are 1 000 metres in one kilometre. The correct answer is number (3). So, the number (3) is written in the blank.

A second type of question asks you to fill in the blank. You are to put what you think is the correct answer in the blank.

The third type of question also asks you to fill in the blank. But, before you fill in the blank you have to measure an object that is on the resource table. Each object on the resource table has been given a letter. Make sure you measure the correct object. If you do not see it someone else may be measuring it. Please wait until they are through; then measure the object and write your answer in the blank.

1. A millimetre is about the size of _____.

   (1) the thickness of a paper clip wire.
   (2) the top of a card table.
   (3) a bathroom scale.
   (4) the length of your little finger.

2. A box has a mass of 37 kilograms. Using metric symbols, this can also be written as 37 _____.

3. Measure the length of the resource table. It is _____metres long.

4. How much salt is in this spoon? _____.

5. A measure that is the same as 43 litres is _____.

   (1) 0.043 ml
   (2) 4 300 ml
   (3) 43 000 ml
   (4) 0.43 ml

6. The distance between New York City and Boston is about 360 kilometres. If you write this using the symbol for kilometres you would write 360 _____.

7. The temperature shown on this thermometer is _____.

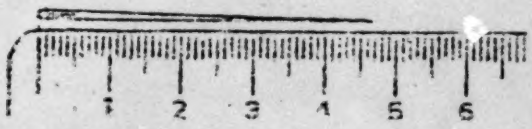
8. This toothbrush is _____cm long.

9. On the resource table is block D. ESTIMATE its mass in kilograms. _____kg.

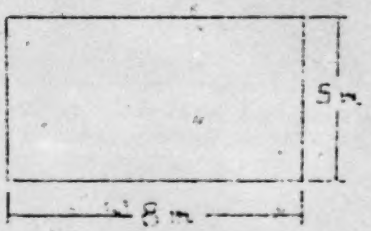
10. On the resource table is a red cardboard square. B. ESTIMATE the length of one side of this square in centimetres. _____cm

11. If you use the symbol for millilitres, 28 millilitres can be written as 28 _____.

12. This needle is _____mm long.



13. The area of this rectangle is _____m^2.



14. On the resource table is a ball, K. Its mass is _____

15. If you use metric symbols, 47 millimetres can also be written as 47 _____.

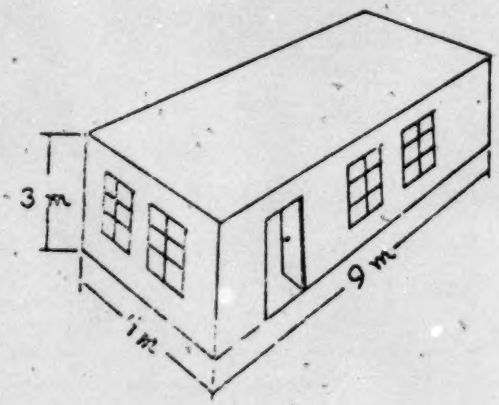
THE CENTER FOR VOCATIONAL EDUCATION

16. The temperature shown on this thermometer is _____°C.

17. Using metric symbols, 273 square metres can also be written as 273 _____.

18. On the resource table is a can, G. Measure its capacity. It is _____millilitres.

19. The area of the floor of the house in this picture is _____.

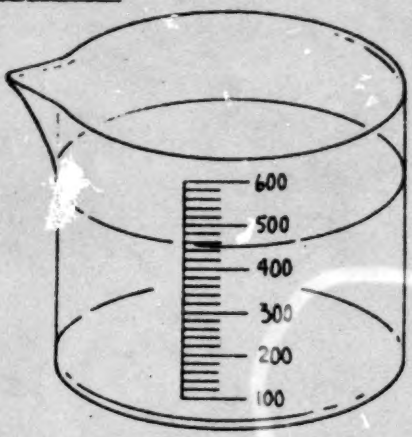


20. A measure that is the same as 934 kilograms is _____.

(1) 0.934 g
(2) 934 000 g
(3) 9.34 g
(4) 93 400 g

21. On the resource table is a can, C. ESTIMATE how many litres can C will hold. _____

22. How much water is in this cup?
_____ml



23. A square metre is about the size of _____.

(1) a card table top.
(2) your thumbnail.
(3) the floor of the classroom.
(4) a 25¢ coin (quarter).

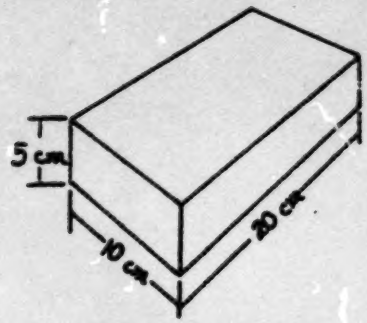
24. A metre is about _____.

(1) the distance you can walk in 12 minutes
(2) the width of a brick.
(3) the height of the ceiling of this room.
(4) the height of a doorknob from the floor.

25. Measure the temperature of the liquid in can N. It is _____.

LEVEL III

26. The volume of this box is _____ cm^3.



27. A measure that is the same as 0.8 cm is _____.

(1) 8 mm
(2) 80 m
(3) 0.08 mm
(4) 8 m

28. If you use metric symbols, 13 cubic metres can also be written as 13 _____.

29. A measure that is the same as 5 000 mm is _____.

(1) 5 cm
(2) 50 m
(3) 500 cm
(4) 50 000 cm

30. On the resource table is a rock labeled E. Measure its volume. Its volume is _____ cm^3.

MATERIALS NEEDED

Form 1

Exercise number	Letter designation	Description
9	D	Block of wood--37 mm x 86 mm x 475 mm
10	B	Large red cardboard square 23 cm on each side
14	K	Solid rubber ball--something like a "Super Ball"
18	G	Large empty frozen orange juice can
21	C	Small empty coffee can
25	N	Any size can, e.g. a soup can (this is used only for holding water).
30	E	A rock

ANSWERS

1. (1)
2. kg
3. Answer depends on length of table used
4. 5 ml
5. (3)
6. km
7. 20°C
8. 9
9. Answer depends on density of block used--allow 25% error in estimates
10. 23--accept answers from 18 cm to 28 cm
11. ml
12. 47
13. 40
14. Answer depends on mass of ball used
15. mm
16. 14
17. m^2
18. Answer depends on size of can used
19. 38 m^2
20. (2)
21. Answer depends on size of can used--allow 25% error in estimates
22. 450
23. (1)
24. (4)
25. Answer depends on temperature of water used
26. 1 000
27. (1)
28. m^3
29. (3)
30. Answer depends on volume of rock used

Form 2

STUDENT TEST BOOKLET

for

METRICS FOR GOOD MEASURE

LEVEL III

Directions

This test has 30 questions. Read each question carefully. There are three kinds of questions on this test.

One type of question is a multiple-choice question. Read each of the possible answers below the question. Pick the number of the answer you think is best. Write the number of this answer in the blank in the question.

Example:

0. There are (3) metres in one kilometre.

(1) 10
(2) 100
(3) 1 000
(4) 10 000

There are 1 000 metres in one kilometre. The correct answer is number (3). So, the number (3) is written in the blank.

A second type of question asks you to fill in the blank. You are to put what you think is the correct answer in the blank.

The third type of question also asks you to fill in the blank. But, before you fill in the blank you have to measure an object that is on the resource table. Each object on the resource table has been given a letter. Make sure you measure the correct object. If you do not see it someone else may be measuring it. Please wait until they are through; then measure the object and write your answer in the blank.

1. A centimetre is about _____.

   (1) the width of a fingernail.
   (2) the thickness of a dime.
   (3) the capacity of a spoon.
   (4) the length of this room.

2. A rock has a mass of 128 grams. Using metric symbols, this can also be written as 128 _____.

3. On the resource table is a block A. Measure the length of this block. It is _____millimetres long.

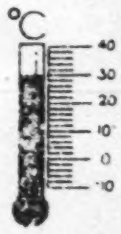
4. How much salt is in this spoon? _____

5. A measure that is the same as 52 ml is _____.

   (1) 52 000 litres
   (2) 5 200 litres
   (3) 0.052 litre
   (4) 0.52 litre

6. The distance between New York City and Boston is about 369 kilometres. If you write this using the symbol for kilometres you would write 369 _____.

7. The temperature shown on this thermometer is _____.



8. This nail is _____cm long.

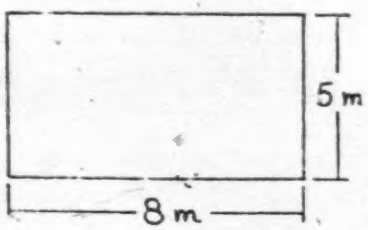
9. On the resource table is a box, H. ESTIMATE its mass in grams._____g.

10. On the resource table is a yellow cardboard square, M. ESTIMATE the length of one side of this square in millimetres._____mm

11. If you use the symbol for millilitres, 28 millilitres can be written as 28_____.

12. This pencil is _____mm long.

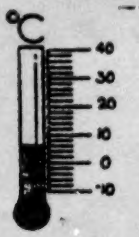
13. The area of this rectangle is _____m^2.



14. On the resource table is a brick, J. Its mass is _____.

15. If you use metric symbols, 47 millimetres can also be written as 47 _____.

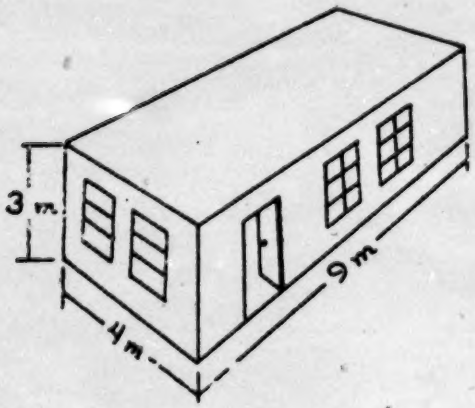
16. The temperature shown on this thermometer is _____°C.



17. Using metric symbols, 48 square metres can also be written as 48_____.

18. On the resource table is a can, F. Measure its capacity. It is _____litres.

19. The area of the floor of the house in this picture is _____.

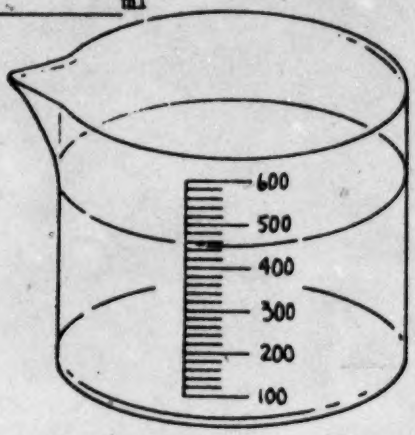


20. A measure that is the same as 187 grams is _____.

(1) 187 000 kg
(2) 0.187 kg
(3) 1.87 kg
(4) 18 700 kg

21. On the resource table is a can, P. ESTIMATE how many litres it holds._____

22. How much water is in this cup?
_____ml



23. A square metre is about the size of _____.

(1) a card table top.
(2) your thumbnail.
(3) the floor of the classroom.
(4) a 25¢ coin (quarter).

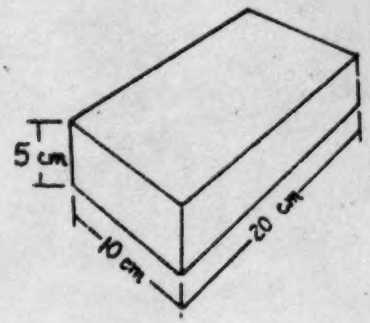
24. A metre is about _____.

(1) the distance you can walk in 12 minutes.
(2) the width of a brick.
(3) the height of the ceiling of this room.
(4) the height of a doorknob from the floor.

25. Measure the temperature of this room. It is _____.

LEVEL III

26. The volume of this box is _____ cm^3.



27. A measure that is the same as 14 km is _____.

(1) 14 000 m
(2) 1.4 cm
(3) 14 000 cm
(4) 1 400 m

28. If you use metric symbols, 13 cubic metres can also be written as 13_____.

29. A measure that is the same as 5 000 mm is _____.

(1) 5 cm
(2) 50 m
(3) 500 cm
(4) 50 000 cm

30. On the resource table is a block labeled L. Measure its volume. Its volume is _____ cm^3.

MATERIALS NEEDED

Form 2

Exercise number	Letter designation	Description
3	A	Block of wood--37 mm x 86 mm x 475 mm
9	H	Small box that is not empty
10	M	Yellow cardboard square 134 mm on each side
14	J	Brick
18	F	Large empty coffee can
21	P	Can--different size from F (should also be different size from C, G and N used in Form 1)
30	L	Block of wood 37 mm x 86 mm x 102 mm

ANSWERS

1. (1)
2. g
3. 475 mm--or whatever length of block used
4. 5 ml
5. (3)
6. km
7. 30°C
8. 6
9. Answer depends on mass of box used--allow 25% error in estimates
10. 134--accept answers from 100 mm to 168 mm
11. ml
12. 86
13. 40
14. Answer depends on mass of brick used
15. mm
16. 6
17. m^2
18. Answer depends on size of can used
19. 36 m^2
20. (2)
21. Answer depends on size of can used--allow 25% error in estimates
22. 450
23. (1)
24. (4)
25. Answer depends on temperature of room
26. 1 000
27. (1)
28. m^3
29. (3)
30. 327.294--accept answers from 320 cm^3 to 335 cm^3

Guidelines for Using the Measurement Module (The International (SI) Metric System)

1. The module is geared to help teachers "think metric". That is to say, it is more important for individuals to have a good "level of comfort" in describing "how much something weighs", "how long something is", "how hot or cold something is", "how much area or space is taken up" etc, using the newer international (SI) units.

   Number manipulations and comparisons of units, etc. are relegated to teaching general math concepts such as proportions, ratios, place values, etc, and should only play a small part in helping individuals to "think metric".

2. Therefore, aside from some specialized materials (i.e. measuring tapes, scales, graduated containers), most materials needed for using the module are things like water, your body, oranges, rice, bricks, etc. No need for expense.

   We recommend using equipment that usually is already available in school labs or shops. Materials are listed at the beginning of each section in the module.

3. Recommended Format:

   I. Overview of the Metric System

      A. Show a film or filmstrip or review the "Brief History of Measurement Systems" (pages 5-6) in the module.

      B. Clearing the Air - have a brief discussion regarding the pros and cons of the change to the metric system. (You may want to use the insert "A message to teachers from SRA" and/or the insert "Answers to a Few Questions You May Have About U.S. Metric Conversion" by Valerie Antoine.)

   II. Help teachers "think metric" by having them do the activities on pages five through twenty in the module.

   III. Review items in Appendixes A, B, and C. It is our hope that teachers will see that there should be little concern in facilitating the changeover to the metric system.